Requirements for the Phase-out of Hydrofluorocarbons

7 DE Admin Code 1151 – Review Committee Meeting

DNREC – DAQ

September 24, 2019

Review Committee Goal

- To help the Department craft/tailor the regulation (*7 DE Admin. Code 1151 Requirements for the Phase-out of Hydrofluorocarbons*) to be representative of Delaware's economic, social and environmental considerations.

Agenda

- Welcome/Introductions
- Hydrofluorocarbon Background Information and Purpose
- Proposed Regulatory Timeline
- Proposed Model Rule
  - Purpose
  - Applicability
  - Definitions
  - List of Prohibited Substances
  - List of Exemptions
- Open Discussion

Who to Contact

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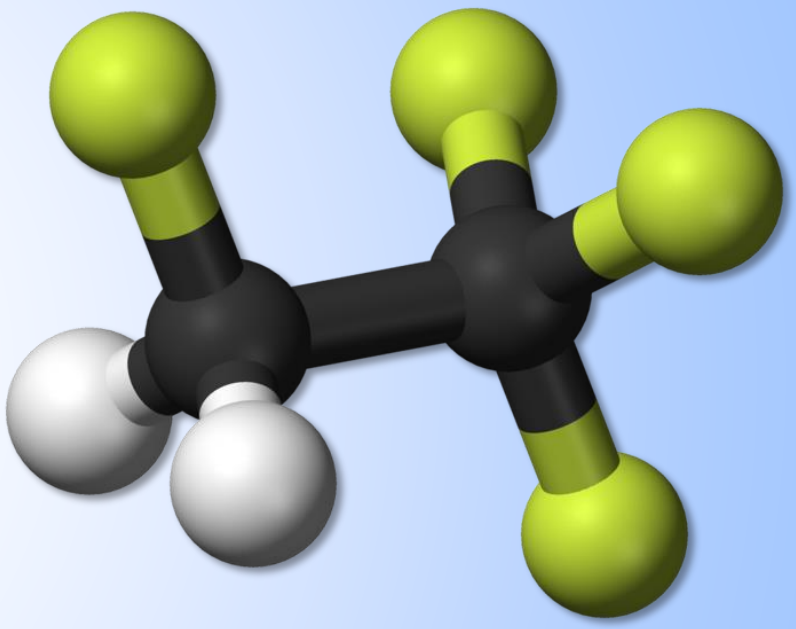
Introduction

- Hydrofluorocarbons (HFC) are gaseous organic compounds that contain hydrogen and fluorine atoms
- HFCs are used across sectors in a variety of applications, including:
  - Air conditioning
  - Refrigeration
  - Foam-blowing
  - Solvents
  - Aerosols
- HFCs are predominantly used in cooling and refrigeration



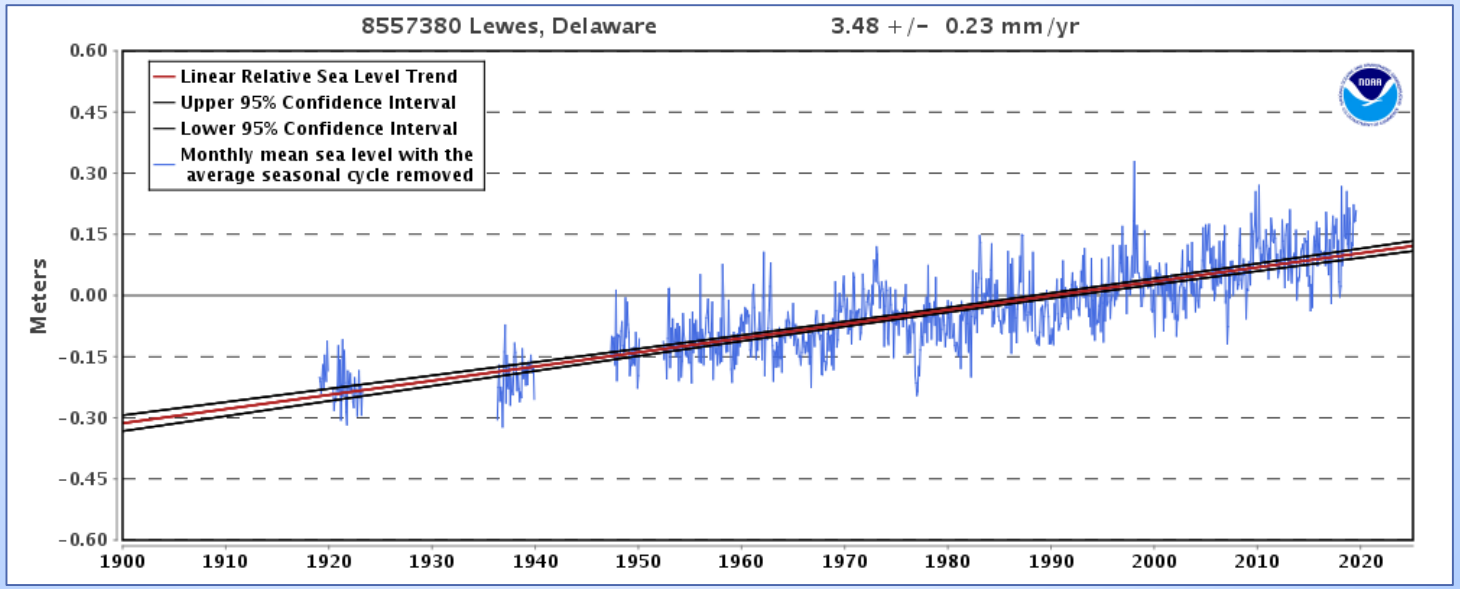
R-134a

Introduction

- The rapid and extensive use of HFCs has become a concern
- In October of 2016, global action was taken in Kigali, Rwanda to address the need to phase down consumption and production of HFCs, as they contribute significantly to climate change
- HFCs are high global warming potential (GWP) greenhouse gases (GHG), meaning emissions have a high radiative warming effect
  - HFC emissions range from hundreds to thousands times greater than that of CO_2 in terms of contributing to climate change

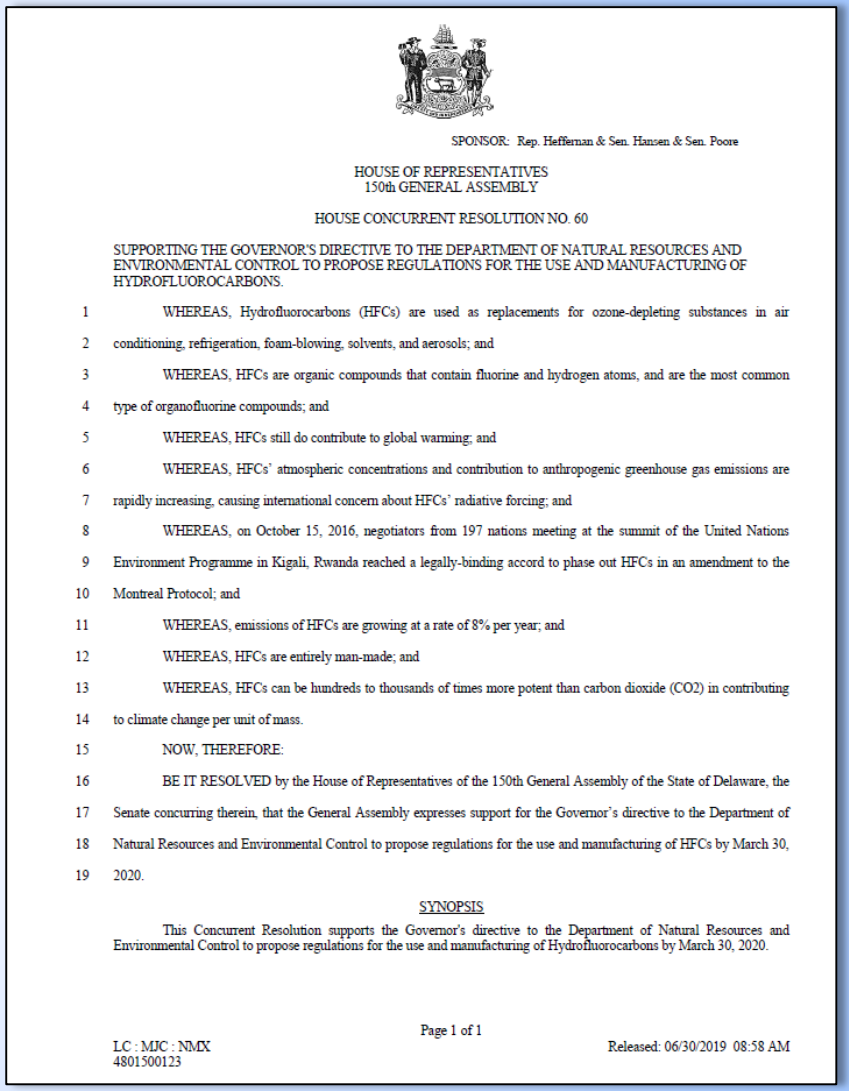
Introduction

- Delaware is already experiencing the effects of climate change
- Increased temperatures pose serious health and economic impacts to farmers, outdoor workers, and sensitive groups such as the elderly and children
- As a low-lying coastal state, Delaware and its citizens and economy are particularly susceptible to sea-level rise
  - Sea levels have already risen by more than 13 inches since 1919, as measured in Lewes, DE
  - Without significant reduction in GHGs, tidal water could inundate as much as 17,000 homes and 500 miles of roadway



Introduction

- Delaware must stay on track to reducing GHG emissions to avoid harmful impacts of climate change
  - Reducing HFC emissions is an important step
- DNREC was directed by Governor Carney with support of the General Assembly to propose regulations for the **use and manufacturing** of HFCs by March 30, 2020
- House Concurrent Resolution 60 of the 150th General Assembly



SPONSOR: Rep. Heffernan & Sen. Hansen & Sen. Poore

HOUSE OF REPRESENTATIVES
150th GENERAL ASSEMBLY

HOUSE CONCURRENT RESOLUTION NO. 60

SUPPORTING THE GOVERNOR'S DIRECTIVE TO THE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL TO PROPOSE REGULATIONS FOR THE USE AND MANUFACTURING OF HYDROFLUOROCARBONS.

WHEREAS, Hydrofluorocarbons (HFCs) are used as replacements for ozone-depleting substances in air conditioning, refrigeration, foam-blowing, solvents, and aerosols; and

WHEREAS, HFCs are organic compounds that contain fluorine and hydrogen atoms, and are the most common type of organofluorine compounds; and

WHEREAS, HFCs still do contribute to global warming; and

WHEREAS, HFCs' atmospheric concentrations and contribution to anthropogenic greenhouse gas emissions are rapidly increasing, causing international concern about HFCs' radiative forcing; and

WHEREAS, on October 15, 2016, negotiators from 197 nations meeting at the summit of the United Nations Environment Programme in Kigali, Rwanda reached a legally-binding accord to phase out HFCs in an amendment to the Montreal Protocol; and

WHEREAS, emissions of HFCs are growing at a rate of 8% per year; and

WHEREAS, HFCs are entirely man-made; and

WHEREAS, HFCs can be hundreds to thousands of times more potent than carbon dioxide (CO_2) in contributing to climate change per unit of mass.

NOW, THEREFORE:

BE IT RESOLVED by the House of Representatives of the 150th General Assembly of the State of Delaware, the Senate concurring therein, that the General Assembly expresses support for the Governor's directive to the Department of Natural Resources and Environmental Control to propose regulations for the use and manufacturing of HFCs by March 30, 2020.

SYNOPSIS

This Concurrent Resolution supports the Governor's directive to the Department of Natural Resources and Environmental Control to propose regulations for the use and manufacturing of Hydrofluorocarbons by March 30, 2020.

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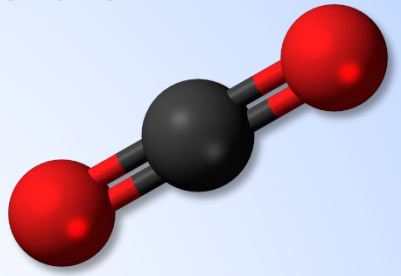
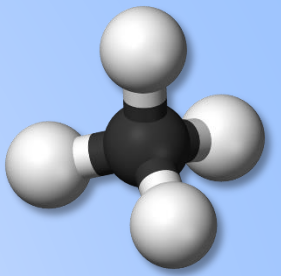
Background and Purpose

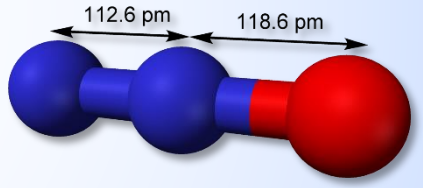
- Since phase-out of ODS, HFC use has been rapidly increasing
- Associated emissions have increased by as much as **8%** annually[1]
- HFCs were identified by the U.S. Environmental Protection Agency (EPA) in the 2009 GHG endangerment finding[2]
- HFCs are one of six GHGs in the atmosphere that "*...threaten the public health and welfare of current and future generations.*"



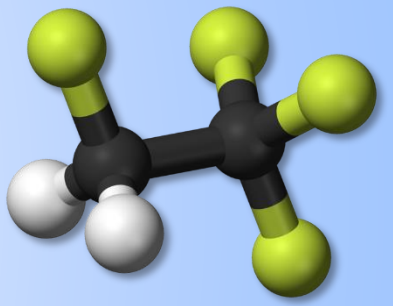
Carbon Dioxide (CO_2)



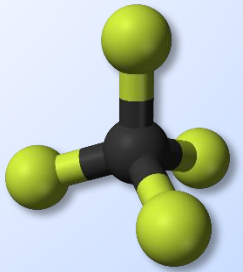
Methane (CH_4)



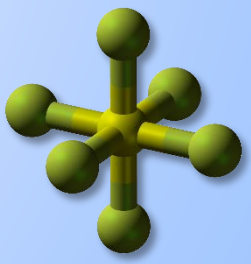
Nitrous Oxide (N_2O)



HFC ($C_2H_2F_4$)
R-134a



PFC (CF_4)
Carbon Tetrafluoride



Sulfur Hexafluoride (SF_6)

Background and Purpose

- HFC emissions are highly potent GHGs
- The GWP is a relative factor comparing the climate-based impact to CO_2
  - e.g. 1 lb of HFC-134a emitted has the same warming effect of 1,430 lbs CO_2 emitted
- GWPs of HFCs are among the highest of all GHGs
- HFCs are used as single components or as blends in a given application
  - One common refrigerant blend is R-410a; a 50/50 blend of HFC-32 and HFC-125

Gas	GWP (100-yr)
CO_2	1
CH_4	25
N_2O	298
HFC-23	**14,800**
HFC-32	**675**
HFC-125	**3,500**
HFC-134a	**1,430**
HFC-143a	**4,470**
HFC-152a	**124**
HFC-227ea	**3,220**
HFC-236fa	**9,810**
HFC-4310mee	**1,640**
PFCs	7,390-12,200
SF_6	22,800

Source: EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2017; IPCC Fourth Assessment Report (AR4)

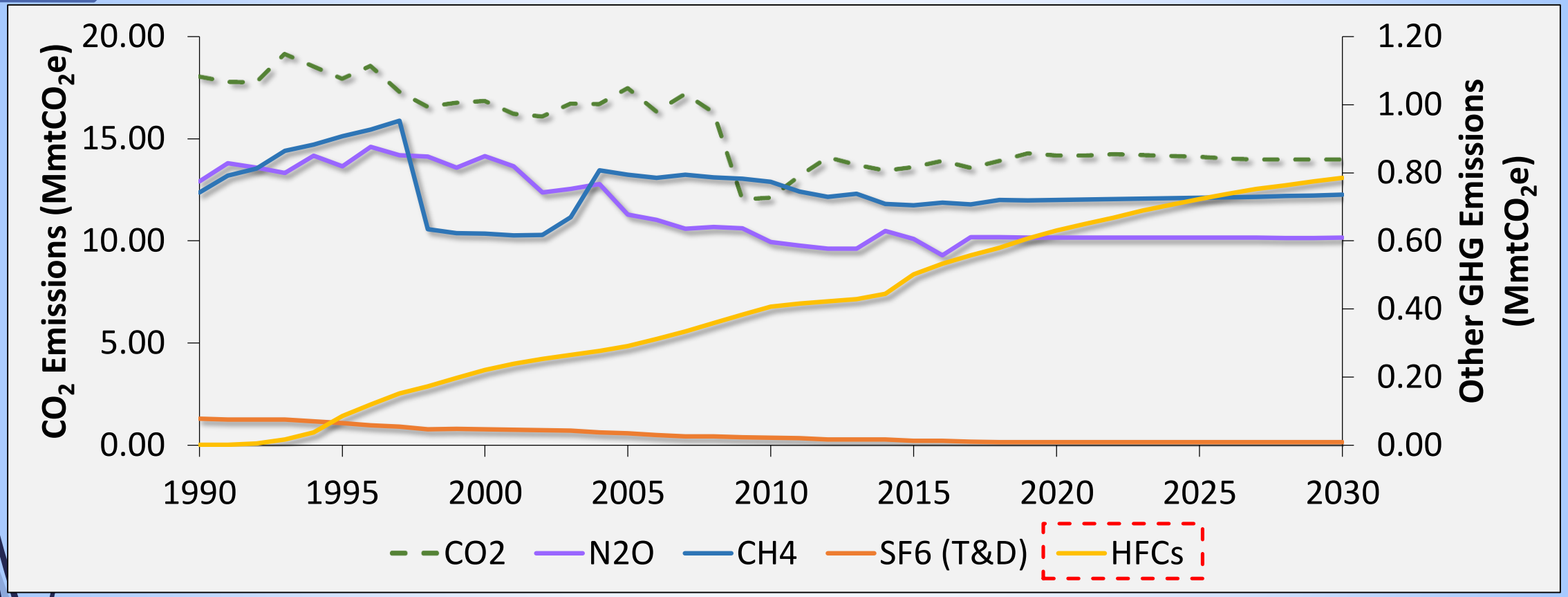
Background and Purpose

- The U.S. EPA had previously sought action to eliminate HFC emissions
- The high-GWP pollutants were listed for phase down schedule under the Significant New Alternative Policy (SNAP) program
- The SNAP program consists of a series of regulations under section 612 of the Clean Air Act
- It requires EPA to evaluate substitutes to ODS to reduce overall risk to human health and environment[1]
- EPA listed various HFCs for use as ODS substitutes in final rules added under the SNAP program in 2015 and 2016[2]

Background and Purpose

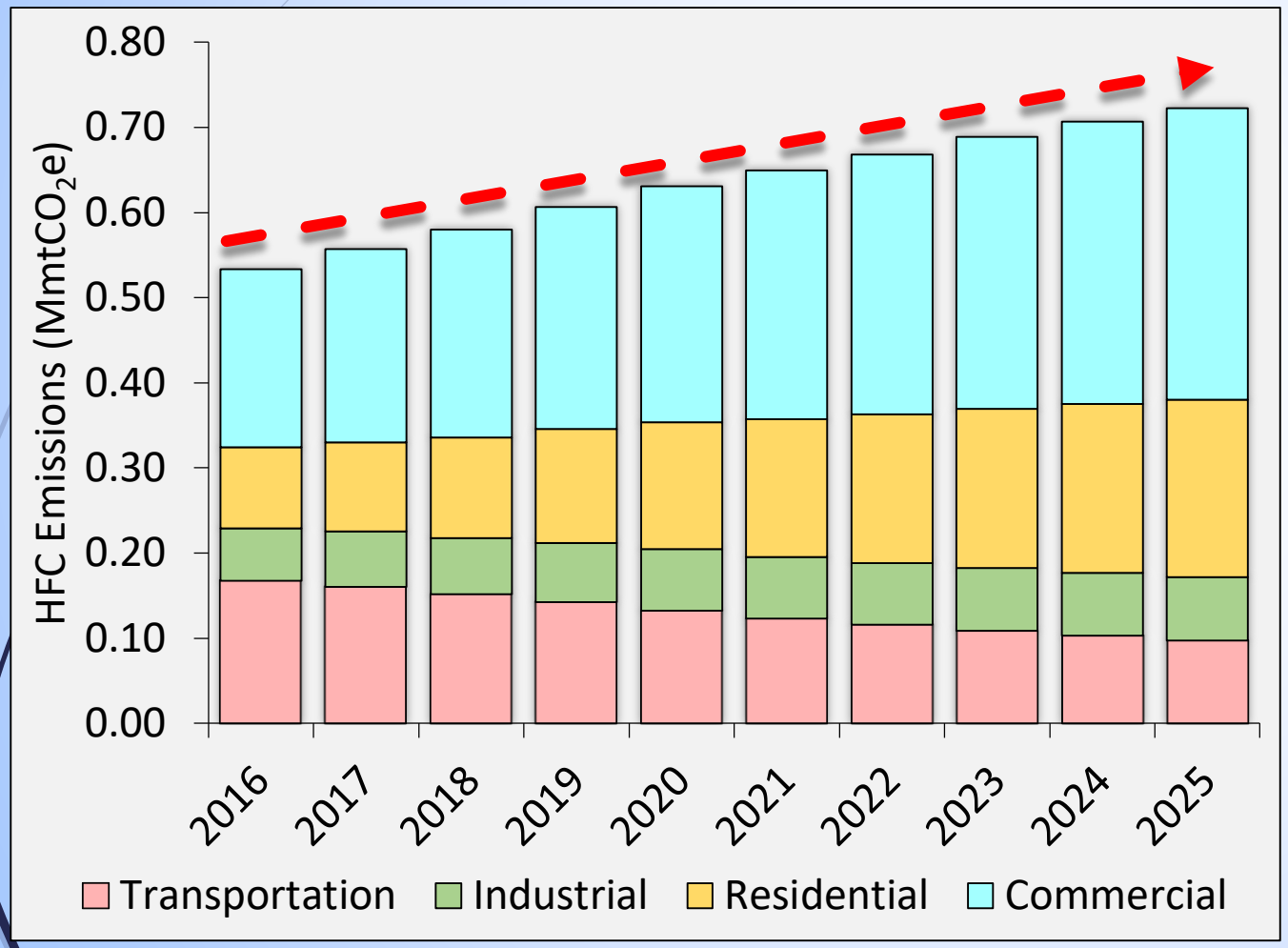
- Federal action through the SNAP program was limited by a court ruling
- Legal action to continue HFC management at the federal level is underway but has no established timeframe
- State action is necessary to limit increasing HFC emissions and he associated harmful climate-based impacts

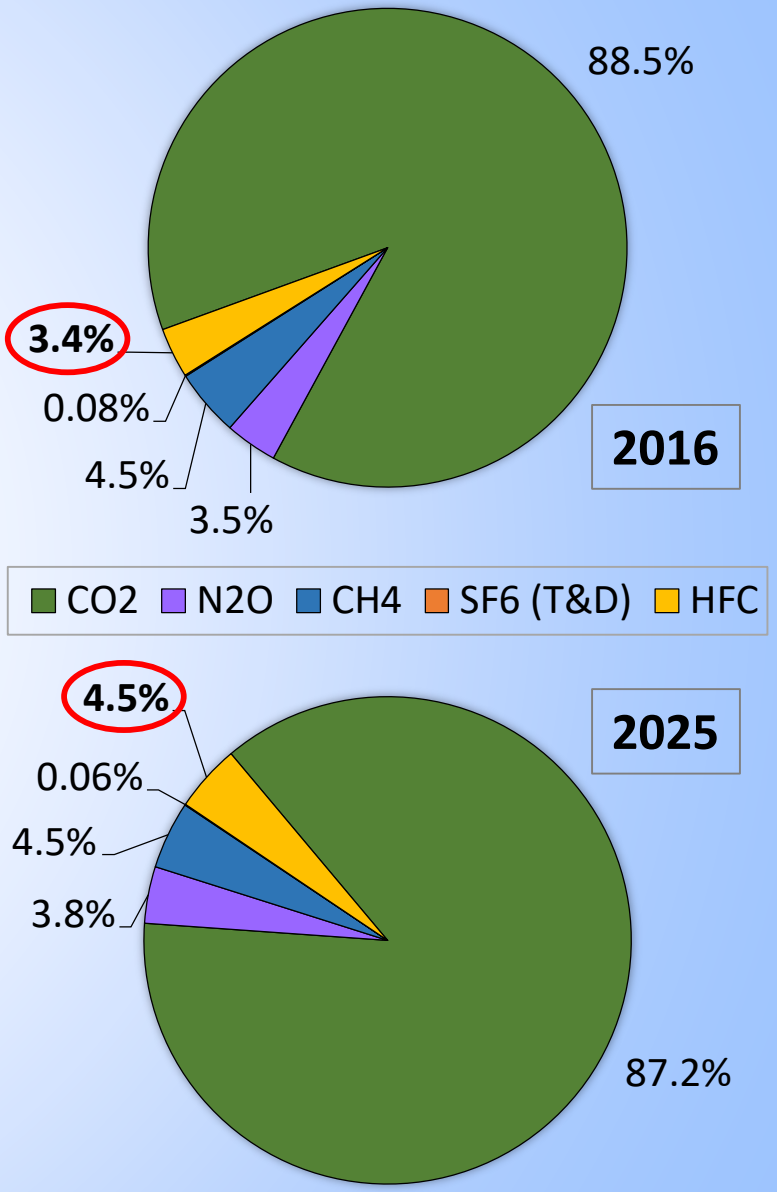
Background and Purpose



- HFCs are the fastest growing GHG in Delaware
- Emissions are projected to increase by 36% from 2016 to 2025

Background and Purpose

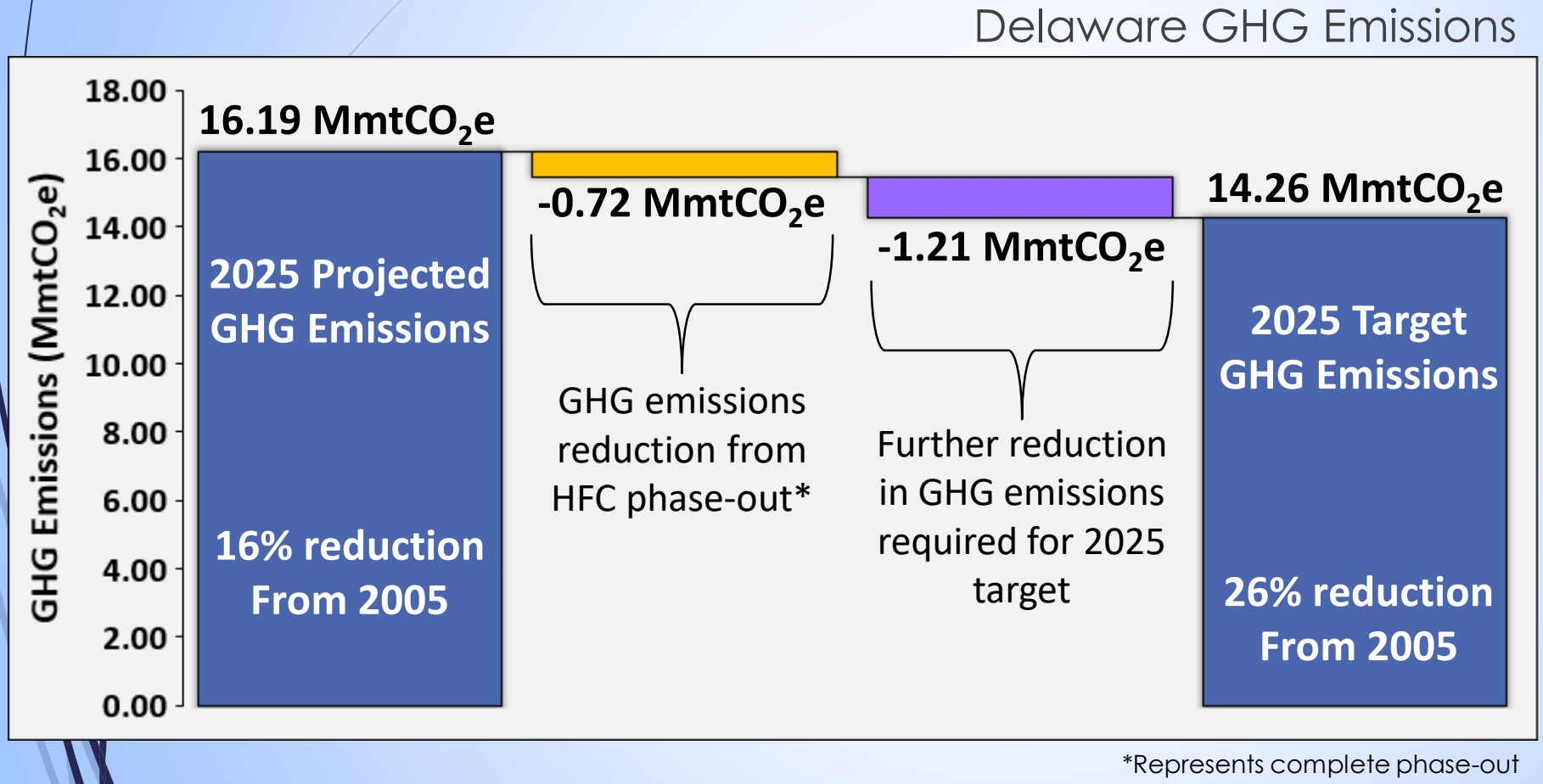




Background and Purpose

- Phase-out of high-GWP HFCs is necessary to mitigate the adverse effects of climate change
- Delaware is especially vulnerable to these impacts as a low-lying coastal state
- Reduction in HFC use will help Delaware achieve its GHG emissions target, set through commitment to the U.S. Climate Alliance
  - 26-28% reduction in GHG emissions from 2005 levels by 2025

Background and Purpose



- HFC phase-out by 2025 would result in 37% of the emissions reduction needed to reach the 2025 GHG emission reduction target

Regulatory Timeline

- Start Action Notice approved August 15, 2019
- Workgroup meetings – September 24, 2019 and October 8, 2019
  - Draft regulation reviewed and edited
  - Website updated

    https://dnrec.alpha.delaware.gov/air/permitting/under-development/
- Public Workshop(s) – TBD Late Fall 2019
- Proposed Regulation – by March 30, 2020

Proposed Model Rule

- 1.0 Purpose
- 2.0 Applicability
- 3.0 Definitions
- 5.0 List of Prohibited Substances
- 6.0 List of Exemptions

Proposed Model Rule

1.0 Purpose

- This regulation establishes the phase-out requirements for the use and manufacturing of hydrofluorocarbons in the State of Delaware by adopting specific United States Significant New Alternatives Policy (SNAP) Program prohibitions for certain substances in air conditioning and refrigeration equipment, aerosol propellants, and foam end-uses. This regulation is designed to support greenhouse gas emissions reductions in the State of Delaware.

Proposed Model Rule

2.0 Applicability

- This regulation applies to any person who sells, offers for sale, installs, uses, or enters into commerce, in the State of Delaware, any substance in end-uses listed in Section 5.0.
- Substances listed in Section 6.0 are exempt from the prohibitions covered in this regulation.
- *Severability*. Each section of this regulation shall be deemed severable, and in the event that any provision of this regulation is held to be invalid, the remainder of this regulation shall continue in full force and effect.

Proposed Model Rule

3.0 Definitions

- "**Effective Date**" or "**Effective Date of Prohibition**" means date after which the prohibitions provided in Section 5.0 go into effect.
- "**New**" means products or equipment that are manufactured after the effective date of this regulation or equipment first installed for an intended purpose with new or used components, expanded by the addition of components to increase system capacity, or replaced or cumulatively replaced such that the capital cost of replacement exceeds 50% of the capital cost of replacing the whole system.
- "**Retrofit**" means the replacement of the refrigerant used in refrigeration equipment with a different refrigerant, and any related changes to the refrigeration equipment required to maintain its operation and reliability following refrigerant replacement.

Proposed Model Rule

3.0 Definitions (Continued)

- "**Use**" means any utilization of a compound or any substance, including but not limited to utilization in a manufacturing process or product in Delaware, consumption by the end-user in the State of Delaware, or in intermediate applications in the State of Delaware, such as formulation or packaging for other subsequent applications. For the purposes of this regulation, use excludes residential use, but it does not exclude manufacturing for the purpose of residential use.
- "**Residential use**" means use by a private individual of a substance, or a product containing the substance, in or around a permanent or temporary household, during recreation, or for any personal use or enjoyment. Use within a household for commercial or medical applications is not included in this definition, nor is use in automobiles, watercraft, or aircraft.

Proposed Model Rule

5.0 List of Prohibited Substances

- Kept the Effective dates in line with vacated SNAP rules
- Pushed back 1 year all initial January 2020 effective dates.

Table 1. End-use and Prohibited substances		
End-use Category: Aerosol Propellants		
End-use	Prohibited Substances	Effective Date
Aerosol Propellants	HFC-125, HFC-134a, HFC-227ea and blends of HFC-227ea and HFC 134a	January 1, 2021 (2020)
End-use Category: Air Conditioning		
End-use	Prohibited Substances	Effective Date
Centrifugal chillers (new)	FOR12A, FOR12B, HFC-134a, HFC-227ea, HFC-236fa, HFC245fa, R-125/ 134a/ 600a (28.1/70/1.9), R-125/ 290/ 134a/ 600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-423A, R-424A, R-434A, R438A, R-507A, RS-44 (2003 composition), THR-03	January 1, 2024 (2024)
Positive displacement chillers (new)	FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R125/ 134a/ 600a (28.1/70/1.9), R-125/ 290/ 134a/ 600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R438A, R-507A, RS-44 (2003 composition), SP34E, THR-03	January 1, 2024 (2024)

Proposed Model Rule

5.0 List of Prohibited Substances

End-use Category: Refrigeration		
End-use	Prohibited Substances	Effective Date
Cold storage warehouses (new)	HFC-227ea, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R404A, R-407A, R-407B, R-410A, R-410B, R-417A, R-421A, R421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R428A, R-434A, R-438A, R-507A, RS-44 (2003 composition)	January 1, 2023 (2023)
Household refrigerators and freezers (new)	FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03	January 1, 2022 (2022)
Household refrigerators and freezers—compact (new)	FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03	January 1, 2021 (2021)
Household refrigerators and freezers—built in appliances (new)	FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03	January 1, 2023 (2023)

End-use Category: Refrigeration		
End-use	Prohibited Substances	Effective Date
Supermarket Systems (Retrofit)	R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R428A, R-434A, R-507A	January 1, 2021 (2020)
Supermarket Systems (New)	HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	January 1, 2021 (2020)
Remote Condensing Units (Retrofit)	R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R428A, R-434A, R-507A	January 1, 2021 (2020)
Remote Condensing Units (New)	HFC-227ea, R-404A, R-407B, R-421B, R-422A, R-422C, R-422D, R-428A, R-434A, R-507A	January 1, 2021 (2020)
Stand-Alone Units (Retrofit)	R-404A, R-507A	January 1, 2021 (2020)
Stand-Alone Medium-Temperature Units (New)	FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R407A, R-407B, R-407C, R-407F, R-410A, R-410B, R417A, R-421A, R-421B, R-422A, R-422B, R-422C, R422D, R-424A, R-426A, R-428A, R-434A, R-437A, R438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, THR-03	January 1, 2021 (2020)
Stand-Alone Low-Temperature Units (New)	HFC-227ea, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R422A, R-422B, R-422C, R-422D, R-424A, R-428A, R434A, R-437A, R-438A, R-507A, RS-44 (2003 formulation)	January 1, 2021 (2020)

Proposed Model Rule

5.0 List of Prohibited Substances

End-use Category: Refrigeration		
End-use	Prohibited Substances	Effective Date
Refrigerated food processing and dispensing equipment (New)	HFC-227ea, KDD6, R-125/ 290/ 134a/ 600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R424A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 formulation)	January 1, 2021 (2021)
Vending Machines (Retrofit)	R-404A, R-507A	January 1, 2021 (2022)
Vending Machines (New)	FOR12A, FOR12B, HFC-134a, KDD6, R125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R407C, R-410A, R-410B, R-417A, R-421A, R-422B, R422C, R-422D, R-426A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), SP34E	January 1, 2022 (2022)
End-use Category: Foams		
End-use	Prohibited Substances	Effective Date
Rigid Polyurethane and Polyisocyanurate Laminated Boardstock	HFC 134a, HFC 245fa, HFC 365mfc, and blends thereof	January 1, 2021 (2020)
Flexible Polyurethane	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof	January 1, 2021 (2020)
Integral Skin Polyurethane	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel Z-6	January 1, 2021 (2020)

End-use Category: Foams		
End-use	Prohibited Substances	Effective Date
Polystyrene Extruded Sheet	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel Z-6	January 1, 2021 (2020)
Phenolic Insulation Board and Bunstock	HFC-143a, HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof	January 1, 2021 (2020)
Rigid Polyurethane Slabstock and Other	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, Formacel Z-6	January 1, 2021 (2020)
Rigid Polyurethane Appliance Foam	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, Formacel Z-6	January 1, 2021 (2020)
Rigid Polyurethane Commercial Refrigeration and Sandwich Panels	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel Z-6	January 1, 2021 (2020)
Polyolefin	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel Z-6	January 1, 2021 (2020)
Rigid Polyurethane Marine Flotation Foam	HFC-134a, HFC-245fa, HFC-365mfc and blends thereof; Formacel TI, Formacel Z-6	January 1, 2021 (2020)
Polystyrene Extruded Boardstock and Billet (XPS)	HFC-134a, HFC-245fa, HFC-365mfc, and blends thereof; Formacel TI, Formacel B, Formacel Z-6	January 1, 2021 (2021)

Proposed Model Rule

5.0 List of Prohibited Substances

End-use Category: Foams		
End-use	Prohibited Substances	Effective Date
Rigid polyurethane (PU) high-pressure two-component spray foam	HFC-134a, HFC-245fa, and blends thereof; blends of HFC365mfc with at least 4 percent HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13 percent HFC-227ea and the remainder HFC-365mfc; Formacel TI	January 1, 2021 (2020)
Rigid PU low-pressure two-component spray foam	HFC-134a, HFC-245fa, and blends thereof; blends of HFC365mfc with at least 4 percent HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13 percent HFC-227ea and the remainder HFC-365mfc; Formacel TI	January 1, 2021 (2021)
Rigid PU one-component foam sealants	HFC-134a, HFC-245fa, and blends thereof; blends of HFC365mfc with at least 4 percent HFC-245fa, and commercial blends of HFC-365mfc with 7 to 13 percent HFC-227ea and the remainder HFC-365mfc; Formacel TI	January 1, 2021 (2020)

Proposed Model Rule

6.0 List of Exemptions

End-use category	Prohibited Substances	Acceptable Uses
Aerosol Propellants	HFC-134a	Cleaning products for removal of grease, flux and other soils from electrical equipment; refrigerant flushes; products for sensitivity testing of smoke detectors; lubricants and freeze sprays for electrical equipment or electronics; sprays for aircraft maintenance; sprays containing corrosion preventive compounds used in the maintenance of aircraft, electrical equipment or electronics, or military equipment; pesticides for use near electrical wires, in aircraft, in total release insecticide foggers, or in certified organic use pesticides for which EPA has specifically disallowed all other lower-GWP propellants; mold release agents and mold cleaners; lubricants and cleaners for spinnerettes for synthetic fabrics; duster sprays specifically for removal of dust from photographic negatives, semiconductor chips, specimens under electron microscopes, and energized electrical equipment; adhesives and sealants in large canisters; document preservation sprays; FDA-approved MDIs for medical purposes; wound care sprays; topical coolant sprays for pain relief; and products for removing bandage adhesives from skin.
Aerosol Propellants	HFC-227ea and blends of HFC-227ea and HFC 134a	FDA-approved MDIs for medical purposes.
Air Conditioning	HFC–134a	Military marine vessels where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.
Air Conditioning	HFC-134a and R-404A	Human-rated spacecraft and related support equipment where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.
Foams – Except Rigid polyurethane (PU) spray foam	All substances	Military applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements until January 1, 2022. (2022)
Foams – Except Rigid polyurethane (PU) spray foam	All substances	Space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements until January 1, 2025. (2025)
Rigid polyurethane (PU) two-component spray foam	All substances	Military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements until January 1, 2025. (2025)

Next Review Committee
October 8 , 2019

- **Division of Coastal Climate and Energy Presentation on the *Cool Switch Program***

- **Continue Reviewing Proposed Model Rule**
  - **5.0 List of Prohibited Substances (Continued)**
  - **6.0 List of Exemptions (Continued)**
  - **4.0 Standards (Requirements)**
    - 4.1 Prohibitions
    - 4.2 Disclosure Statement
    - 4.3 Recordkeeping

Thank you!

Discussion and Questions

Next meeting scheduled for October 8, 2019

Location: 715 Grantham Ln, New Castle, DE 19720

West Conference Room

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